

7 GENERAL

The FGS is primarily intended to assist the flight crew in the basic control and tactical guidance of the airplane. The system may also provide workload relief to the pilots and may provide a means to fly a flight path more accurately to support specific operational requirements (e.g. RVSM, RNP, etc.).

The applicant should establish, document and follow a design philosophy that supports the intended operational use regarding the FGS behavior; modes of operation; pilot interface with controls, indications, and alerts; and mode functionality.

Description of the FGS behavior and operation should be addressed from flight crew and maintenance perspectives in appropriate documentation and training material.

Subsequent sections of this advisory material provide acceptable means of compliance with §/JAR 25.1329 and the applicability of other Part 25 rules to FGS (e.g., §/JAR 25.1301, §/JAR 25.1309). The demonstrated means of compliance may include a combination of analysis, laboratory testing, flight testing, and simulator testing. The applicant should coordinate with the authorities early in the certification program, via a certification plan, to reach agreement on the methods to be used to demonstrate compliance.

7.1 Flight Guidance System Functions

The following functions, when considered separately and together, are considered elements of a Flight Guidance System:

- Flight guidance and control (e.g., autopilot, flight director displayed head-down or head-up);
- Autothrottle/autothrust systems;
- Interactions with stability augmentation and trim systems; and
- Alerting, status, mode annunciation, and situation information associated with flight guidance and control functions.

The FGS includes those functions necessary to provide guidance and control in conjunction with an approach and landing system, such as:

- the Instrument Landing System (ILS),
- the Microwave Landing System (MLS) or
- the Global Navigation Satellite System (GNSS) Landing System (GLS).

The FGS also includes those functions necessary to provide guidance and control in conjunction with a Flight Management System (FMS). The FGS does **not** include the flight planning and the generation of flight path and speed profiles tied to waypoints and other flight planning aspects of the Flight Management System (FMS). However, it does include the interface between the FMS and FGS necessary for the execution of flight path and speed commands.

7.2 FGS Components

For the purpose of this AC/ACJ the term “FGS” includes all the equipment necessary to accomplish the FGS function, including the sensors, computers, power supplies, servo-motors/actuators, and associated wiring. It includes any indications and controllers necessary for the pilot to manage and supervise the system.

Any part of the FGS that remains mechanically connected to the primary flight controls or propulsion controls when the Flight Guidance System is not in use is regarded as a part of the primary flight controls and propulsion system, and the provisions for such systems are applicable.

7.3 Compliance with FAR/JAR 25.1329

Table 7.3-A lists the relevant paragraphs of §/JAR 25.1329 and provides an indication where acceptable means of compliance with each paragraph may be found within this AC.

TABLE 7.3-A.

Where Means of Compliance Can Be Found in this AC

Section / Paragraph	Rule Text	Where Acceptable Means of Compliance Found in this AC
§/JAR 25.1329 (a)	<i>Quick disengagement controls for the autopilot and autothrust functions must be provided for each pilot. The autopilot quick disengagement controls must be located on both control wheels (or equivalent). The autothrust quick disengagement controls must be located on the thrust control levers. Quick disengagement controls must be readily accessible to each pilot while operating the control wheel (or equivalent) and thrust control levers.</i>	Section 8.1, Autopilot Engagement/Disengagement and Indications Section 8.3, Autothrust Engagement/Disengagement and Indications
§/JAR 25.1329 (b)	<i>The effects of a failure of the system to disengage the autopilot or autothrust functions when manually commanded by the pilot must be assessed in accordance with the requirements of §/JAR 25.1309.</i>	Section 8.1, Autopilot Engagement/Disengagement and Indications Section 8.3, Autothrust Engagement/Disengagement and Indications Section 13.6, Safety Assessment – Failure to Disengage the FGS
§/JAR 25.1329 (c)	<i>Engagement or switching of the flight guidance system, a mode, or a sensor must not produce a significant transient response affecting the control or flight path of the airplane.</i>	Section 8, FGS Engagement, Disengagement, and Override Section 13, Safety Assessment
§/JAR 25.1329(d)	<i>Under normal conditions, the disengagement of any automatic control functions of a flight guidance system must not produce any significant transient response affecting the control or flight path of the airplane, nor require a significant force to be applied by the pilot to maintain the desired flight path.</i>	Section 8, FGS Engagement, Disengagement, and Override Section 13, Safety Assessment

§/JAR 25.1329 (e)	<i>Under other than normal conditions, transients affecting the control or flight path of the airplane resulting from the disengagement of any automatic control functions of a flight guidance system must not require exceptional piloting skill or strength to remain within, or recover to, the normal flight envelope.</i>	Section 8, FGS Engagement, Disengagement, and Override
§/JAR 25.1329 (f)	<i>Command reference controls (e.g., heading select, vertical speed) must operate consistently with the criteria specified in §/JAR 25.777(b) and 25.779(a) for cockpit controls. The function and direction of motion of each control must be plainly indicated on, or adjacent to, each control if necessary to prevent inappropriate use or confusion.</i>	Section 9, Controls, Indications and Alerts
§/JAR 25.1329 (g)	<p><i>Under any condition of flight appropriate to its use, the Flight Guidance System must not:</i></p> <ul style="list-style-type: none"> <i>produce unacceptable loads on the airplane (in accordance with §/JAR 25.302), or</i> <i>create hazardous deviations in the flight path.</i> <p><i>This applies to both fault-free operation and in the event of a malfunction, and assumes that the pilot begins corrective action within a reasonable period of time.</i></p>	<p>Section 10, Performance of Function</p> <p>Section 13, Safety Assessment</p> <p>Section 14, Compliance Demonstration using Flight Test and Simulation</p>
§/JAR 25.1329 (h)	<i>When the flight guidance system is in use, a means must be provided to avoid excursions beyond an acceptable margin from the speed range of the normal flight envelope. If the aircraft experiences an excursion outside this range, the flight guidance system must not provide guidance or control to an unsafe speed.</i>	Section 10.4, Speed Protection
§/JAR 25.1329 (i)	<i>The FGS functions, controls, indications, and alerts must be designed to minimize flight crew errors and confusion concerning the behavior and operation of the FGS. Means must be provided to indicate the current mode of operation, including any armed modes, transitions, and reversions. Selector switch position is not an acceptable means of indication. The controls and indications must be grouped and presented in a logical and consistent manner. The indications must be visible to each pilot under all expected lighting conditions.</i>	Section 9, Controls Indications and Alerts

§/JAR 25.1329 (j)	<i>Following disengagement of the autopilot, a visual and aural warning must be provided to each pilot and be timely and distinct from all other cockpit warnings.</i>	Section 8.1.2.1, Autopilot Disengagement Alerts Section 13, Safety Assessment
§/JAR 25.1329 (k)	<i>Following disengagement of the autothrust function, a caution must be provided to each pilot.</i>	Section 8.3.2, Autothrust Disengagement Section 13, Safety Assessment
§/JAR 25.1329 (l)	<i>The autopilot must not create an unsafe condition when the flight crew applies an override force to the flight controls.</i>	Section 8.4.1, Flight Crew Override of the FGS – Autopilot Section 13, Safety Assessment
§/JAR 25.1329 (m)	<i>During autothrust operation, it must be possible for the flight crew to move the thrust levers without requiring excessive force. The autothrust response to flight crew override must not create an unsafe condition.</i>	Section 8.4.2, Flight Crew Override of the FGS - Autothrust Section 13, Safety Assessment